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An investigation of visual skills in athletics

Abstract

This study set out to investigate the questions of whether visual skills abilities are better in athletes than non-athletes and whether there is a difference in these same skills between men and women. For the purpose of this study, the visual skills abilities that were evaluated were dynamic visual acuity, ocular motility, stereoscopic depth perception, eye-hand coordination and central/peripheral awareness. The statistics showed that there was no overall significant difference in those visual skills measured between athletes and non-athletes, or between men and women. However, when statistics of individual tests were examined, results showed that the athletes scored significantly better than non-athletes on the Groffman Visual Tracing correct score test and on dynamic visual acuity testing. The non-athletes scored significantly better on the Duane Saccadic Fixator Reaction test. Visual skills differences between men and women was negligible according to this analysis. It is difficult to explain why athletes scored better on some tests while non-athletes scored better on others. The small sample size could be a factor. Another possibility is that the tests used may not be accurate indicators of the visual skills required in athletics. If these tests are accurate indicators of those visual skills required in athletics, it is then also possible for a non-athlete to perform well on these same tests, possibly due to experience in non-sports related activities requiring similar visual skills. It would obviously be very difficult to control for these variables. Since we found no differences in visual skills abilities ascribable to the sex of the subject alone, we suggest that women who begin their athletic training at comparable ages to men athletes will possess sports vision skills equal to those men.

Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Steven J. Cool

Subject Categories

Optometry

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AN INVESTIGATION OF
VISUAL SKILLS IN ATHLETICS

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Pacific University College of Optometry
March 15, 1982

sports Medicine
Racquetball - Physiological Aspects

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Acknowledgements

We would like to express our appreciation to Dr. Steven Cool, for his invaluable suggestions and assistance with this project. Our thanks also to Dr. Paul Kohl for his input in the initial stages of planning the research design.

This research could not have been conducted had it not been for the cooperation of Devri Sharp, members of the Beaverton Racquetball Club, and many of the patients at the Pacific University College of Optometry clinic. We thank you all very much.

ABSTRACT

This study set out to investigate the questions of whether visual skills abilities are better in athletes than non-athletes and whether there is a difference in these same skills between men and women. For the purpose of this study, the visual skills abilities that were evaluated were dynamic visual acuity, ocular motility, stereoscopic depth perception, eye-hand coordination and central/peripheral awareness.

The statistics showed that there was no overall significant difference in those visual skills measured between athletes and non-athletes, or between men and women. However, when statistics of individual tests were examined, results showed that the athletes scored significantly better than non-athletes on the Groffman Visual Tracing correct score test and on dynamic visual acuity testing. The non-athletes scored significantly better on the Duane Saccadic Fixator Reaction test. Visual skills differences between men and women was negligible according to this analysis.

It is difficult to explain why athletes scored better on some tests while non-athletes scored better on others. The small sample size could be a factor. Another possibility is that the tests used may not be accurate indicators of the visual skills required in athletics. If these tests are accurate indicators of those visual skills required in athletics, it is then also possible for a non-athlete to perform well on these same tests, possibly due to experience in non-sports related activities requiring similar visual skills. It would obviously be very difficult to control for these variables. Since we found no

differences in visual skills abilities ascribable to the sex of the subject alone, we suggest that women who begin their athletic training at comparable ages to men athletes will possess sports vision skills equal to those men.

INTRODUCTION

It is generally accepted in the field of optometry that vision provides signals that direct the muscles of the body to respond. If this is the case, then it is possible that those people who are good athletes (thereby implying superior motor skills), may also have superior visual abilities.

In a review of the sports vision related literature, Arterburn and Stine (1981)* summarized the results of investigations dealing with the visual abilities of athletes compared to non-athletes, and the transference of the training of visual abilities to the performance of the athlete. They conclude that the literature does support the concept that athletes have better visual-motor integration than their less-accomplished competitors. The visual skills which seem to demonstrate this are: extent of visual field, extent of field of peripheral acuity, extent of field of motion perception, smaller near and far heterophorias, depth perception, dynamic visual acuity, near point of convergence, and ocular motilities.

One of these areas in which we are particularly interested is dynamic visual acuity. A study was done in 1971 by Beals, et al.,¹ where a correlation of .76 was found between dynamic visual acuity and field shooting accuracy in basketball players. In a study of dynamic visual acuity in high and low accuracy female basketball

*Arterburn, Mike and Doug Stine. "Vision and Sports". unpublished doctoral thesis, Pacific University College of Optometry, 1981.

players, Morris and Kreighbaum (1977)⁷ did not find a statistically significant difference between the high and low accuracy players, although their data did show a tendency toward better dynamic visual acuity in the high percentage shooters.

In a 1974 study by Sanderson and Whiting,⁸ subjects were required to catch a mechanically tossed tennis ball. The relationship between their ability to do this task and their static and dynamic visual acuity was analyzed. The results showed that dynamic visual acuity and catching performance were significantly related but that static visual acuity and dynamic visual acuity were not significantly related.

There is disagreement in the literature as to whether there is a relationship between static visual acuity and dynamic visual acuity. Miller and Ludvigh (1956)⁶ found that there was no relationship. Hulbert, et al. (1958)⁵ found a correlation between static visual acuity and binocular dynamic visual acuity at target speeds of 20°/second and 60°/second, but not at 120°/second or 180°/second. He suggested that there is a critical dynamic visual acuity target speed above which the relationship between static visual acuity and dynamic visual acuity breaks down. Burg and Hulbert (1961)⁴ did a study comparing static visual acuity with dynamic visual acuity under two conditions, first allowing free head movement and a second time with the head fixed. Fixed-head visual acuity correlated with static acuity to a lesser extent than did dynamic visual acuity with head movement unrestricted. They explained this as being due to the reduced time that the subject can view the target clearly in the fixed head position. Burg and Hulbert suggested that factors other than static visual acuity are involved

in dynamic visual acuity ability. These factors are presently unknown, but integration of the oculomotor system, attention, and practice are thought to be possibilities. In Burg's 1964 report² investigating the relationship between driving record, static visual acuity, dynamic visual acuity, age, and sex, he concluded that the relationship between dynamic visual acuity and static visual acuity was strong and that "in all probability, static acuity can be considered the best single predictor of dynamic visual acuity." *

Weissman and Freeburne (1965)⁹ studied the relationship between dynamic visual acuity and static visual acuity, as well as the nature of the relationship between them. They concluded that when subjects are pre-selected on the basis of static visual acuity (20/20 acuity or better) the resulting correlation between static visual acuity and any other variable would necessarily decrease. As the range of static visual acuity scores increases, the correlation between static visual acuity and another variable (e.g. dynamic visual acuity) would necessarily increase. This explains the differences found between Burg's results and Miller and Ludvigh's.

One particular area of dynamic visual acuity that we examined in this study is the difference in dynamic acuity between males and females. In three reports in the literature,^{2,3,4} there was a consistent trend showing superior dynamic visual acuity abilities for males over females. Burg (1966)³ stated that several theories

*Burg, A. "An Investigation of Some Relationships Between Dynamic Visual Acuity, Static Visual Acuity and Driving Record." Report 64-18, Los Angeles, California: University of California Engineering Dept., 1964, p. 99.

had been presented for this difference, such as differential motivation and physiological and/or physiognomic differences. We would like to suggest another possibility. All of these studies were published in the early 1960's. At that period in time, school age girls were not heavily involved in athletics or a number of other activities to the same degree that boys were. Today, young girls and boys are more equally involved in the same activities, and we were interested in finding out whether these significant differences between the women and men still exist today. Additionally, this study examined differences between athletes and non-athletes on a variety of visual and visual-motor skills as well as examining dynamic visual acuities.

METHODS

1) SUBJECTS

a) Experimental Group (Athletes). Athletes were defined as players who participated in racquetball or handball three times per week or more and were rated in the A or B class at their club. Eighteen men and eight women volunteered for testing at the Beaverton Racquetball Club. From this group, six men and six women who met a criterion of 20/20 static visual acuity were selected for inclusion in the study.

b) Control Group (Non-athletes). Non-athletes were defined as people who have not participated in an individual or team "ball" sport on the intramural, varsity or professional level since high school or college. The control group was matched to the experimental group on the basis of age within one year, and static acuity corrected to 20/20.

Racquetball and handball were selected as the athletic criterion sport because of their high demand for hand-eye coordination and visual predictability of a dynamic target. Each athlete and age-matched non-athlete was measured for performance on nine visual tasks which relate to sports vision training: static acuity, stereoacuity, rotating pegboard, visual tracing pursuits, near peripheral awareness, near saccades, and dynamic visual acuity. The subjects performed on a volunteer basis and optometry students familiar with the skills tests were not used in the study.

2) Procedures

a) Dynamic visual acuity was tested using the apparatus designed and tested by Inverso and Hoover (1981)*. It consists of three plane mirrors mounted on a rotating turntable and a slide projector. Slides of a set of three 20/30 Snellen letters were projected across a nine foot wide white screen. The angular velocity of the projected letters was decreased until the subject could recognize them. An arbitrary scale value which is related to the turntable RPM value was recorded for each subject in the restricted head movement condition. This value was then converted to angular velocity. The illumination was held constant for all subjects.

*Hoover, Kim and John Inverso. "Dynamic Visual Acuity Measurement: The Design and Construction of a Clinically Useful Instrument" unpublished doctoral thesis, Pacific University College of Optometry. 1981.

b) Hand-eye coordination was measured by a timed test using the rotating pegboard. The pegboard was mounted on a table surface and rotated at a speed of 20 RPM. Each subject was instructed to insert the golf tee pegs into the pegboard holes, working from the outer edge toward the center and disregarding color matching. The number of pegs inserted in a 30-second time period was recorded.

c) Binocular status was evaluated by the Worth Four Dot test. Each subject gave a report of the number and color of the dots while wearing complementary red and green colored filter glasses at distances of 16 inches and 10 feet.

d) Stereoscopic depth perception was evaluated by the Wirt/Julesz stereocard and the Aviator stereocard series. The Wirt/Julesz test required the subject to select which of four circles is most prominent in forward "float" while wearing Polaroid glasses. The minimum disparity value is 40 arcseconds.

The Aviator series of halfviews was viewed through a Brewster stereoscope. The subject was presented cards with three vertical rows of letters of various acuity demand. The subject selects one letter in each row which is standing forward in stereoscopic depth. The minimum disparity value for this test is 15 arcseconds.

e) Central/peripheral awareness was measured by the McDonald Peripheral Awareness Card. The subject fixated the center of the card from a distance of 5 inches and reported the letters that could be seen in each quadrant of the card. The number of letters correctly reported in each quadrant was recorded.

f) Eye movements were evaluated by the Groffman Visual Tracing Test. Five visual mazes were present on the paper and the subjects were timed as each maze was followed, using only the eyes,

from start to finish. One score was given for the amount of time needed to complete all five mazes, overall time (OAX), and one score was given for the average amount of time needed to complete a maze to its correct endpoint (CSX). The number of mazes completed to their correct endpoint (CS) was also recorded.

g) The Duane Saccadic Fixator requires quick hand and eye movements in order to press buttons located beside each of sixteen flashing lights that are in a circular arrangement. Only one light flashes at any one time. The instrument was mounted upright on the wall and used to test the following abilities:

Proaction^{*}: The Fixator was set so that lights flashed in a random pattern. The subject was instructed to push the button beside whichever light was illuminated. A new light flashed on only when the previous light's button had been touched, so the number of lights touched in any 30 second period was totally determined by the speed of the subject's hand and eye movements.

Reaction^{**}: The lights flashed in a random pattern at a set rate of one per second. A score was given only if the button was pressed at the moment the light was illuminated. The subjects tried to touch as many lights as possible in 30 seconds.

Visual Predictability^{***}: The instrument was set so that the lights flashed around the board in a circle, sequentially. Each

*Sherman, Arnold. Sports Vision Seminar. Pacific University College of Optometry. May, 1981.

** Sherman, Arnold. Sports Vision Seminar

*** Sherman, Arnold. Sports Vision Seminar

light was labelled with a number. The examiner indicated the numbers of the four lights that the subject was to try to touch exactly as they flashed. The instrument was set so that lights numbered one through sixteen turned on sequentially in fifteen seconds (one cycle). The subject was requested to touch lights numbered 4,8,12, and 16, in order, as they lit up. The number of lights touched in one cycle was recorded.

The subject was free to choose any body position and head position desired for these three tests and two hands could be used. Because of the potential practice effect, only one opportunity to complete the task was provided.

Testing was conducted at the Beaverton Racquetball Club for the experimental group and at the Pacific University Optometry Clinic for the control group.

RESULTS

All subjects tested 20/20 or better in static acuity, produced a binocular response on the Worth Four Dot test and had 40 arcseconds of stereoacuity measured on the Wirt/Julesz stereocard. One person in the female athlete group proved to have 25 arcseconds stereoacuity on the Aviator card series. Because these data were essentially constant for all subjects they were not included in the data analysis.

The data were analyzed using a three-way analysis of variance with repeated measures in one dimension, and Scheffe's "Data Snooping" t-test. The results are summarized in Tables 1 and 2.

The analysis of variance shows that there is a significant difference among the scores of the visual skills tests (Factor 3),

but since the scales of the separate tests are not comparable, this result is not unexpected. For instance, a top score on the Duane Proaction test could be 50, while the maximum score on the Peripheral Awareness test in any quadrant is seven.

The statistics show that there is no overall significant difference in the visual skills measured between athletes and non-athletes (Factor 1), or between men and women (Factor 2). This is not to suggest that there are actually no differences in these groups. There may be a positive difference in some tests in a group and negative differences on other tests. This could result in the "no difference" net effect.

An appropriate interaction effect could suggest that athletes do better on some tests, non-athletes do better on other tests and the two groups do about equally well on yet other tests. The athletes compared to the non-athletes by visual skills tests interaction (Factor 1 X Factor 3) is the portion of the analysis that would show these differences, and, in fact a significant Factor 1 x Factor 3 interaction effect is indicated by the analysis ($p < .005$).

Scheffe's "Data Snooping" t-test was used to investigate these differences more closely. The "Data Snooping" test is designed to show where the visual skills differences between athletes and non-athletes lie. Results showed that the athletes scored significantly better than the non-athletes on the Groffman CSX ($p < .001$) and dynamic visual acuity ($p < .025$). The non-athletes scored better than the athletes on the Duane Saccadic Fixator Reaction test ($p < .001$).

The visual skills differences between men and women appear to be negligible according to this analysis. On all individual tests, men's and women's test scores are quite similar, with the highest scores for the rotating pegboard found among the women, and the highest scores for the Groffman Visual Tracing and dynamic visual acuity found among the men.

DISCUSSION

The data suggests that there are no overall differences between men and women or between athletes and non-athletes. We consider this a pilot study because the sample size was small due to the criteria set for entrance to the study. Clearly, a full scale study with larger groups could verify the findings found among the groups.

The three skills tested that showed significant differences between the athletes and the non-athletes did not consistently show one or the other as having the better score. The non-athlete group performed better on the Reaction test on the Duane Saccadic Fixator. This performance indicates that the non-athletes had the quicker hand and eye movements and quicker reflexes than the athletes. On an intuitive level this is a difficult result to explain. It is indeed possible that the eye-hand coordination demand of this test is not at all related to that demanded by racquetball, in which case we could not expect the racquetball players to necessarily score higher than the non-athlete group. Another possibility is that the subjects in the non-athlete group are involved in activities other than sports which require fine hand-eye coordination, such as working with certain types of machinery. Again, this finding may also be a result of the

the small sample size. We would suggest that a larger sample of athletes and non-athletes would be needed to substantiate this finding.

Although the non-athlete criteria required subjects who do not compete in any sport demanding hand-eye or hand-to-ball coordination, the non-athletes may still have been active in other sports such as running, weight lifting, or skiing. None of the subjects classified as non-athletes were actually in a dormant lifestyle or in out-of-average physical condition for their age. Also, as we alluded to in the preceding paragraph, many other activities besides sports require the skills we were testing. It would be very difficult to hold all of those variables constant.

The athlete group showed better scores on the Groffman Visual Tracing correct score test. The test is performed at near and indicates that the athlete is better suited to this particular near demand requiring eye movements with no motor feedback.

The athletes also showed significantly higher scores on dynamic visual acuity than the non-athletes. Since all subjects in the study were capable of 20/20 acuity and the letters used in the Dynamic Visual Acuity test were 20/30, it would seem that this difference is due to some other factor than static visual acuity. The relationship of static visual acuity and dynamic visual acuity remains ambiguous with the data here suggesting that static visual acuity is not " the best single predictor of dynamic visual acuity" as the Burg and Hulbert report states.

*Burg, A. and S. Hulbert. "Dynamic Visual Acuities as Related to Age, Sex, and Static Acuity." J. Appl. Psychol. 45: 111-116, 1961.

Our results give no indication of a difference in dynamic visual acuity or any other skill between men and women. The subjects tested ranged in age from 20 to 39 years, and the separate scores of the men and women subjects in the 20 to 28 year age bracket showed no remarkable differences. From this, we can conclude that the women who begin their athletic training at comparable ages to the men athletes should possess sports vision skills equal to those men.

The amount of variability in the testing of all groups was minimized by a standardized reading of the instructions to each subject. Even so, the amount of variability in the data taking sequence may have affected the data. The tests were not run in exactly the same order with each subject. In addition, some of the athletes were being tested before playing racquetball, while some were tested after playing, thereby introducing variables of fatigue and attention level.

The area of sports vision and norms for sports-related visual skills are just beginning to be investigated. We conclude that athletes do have significantly better dynamic visual abilities than do non-athletes and that no differences in visual skills abilities are ascribable to the sex of the subjects alone. It is hoped that extensive further studies will further verify these conclusions and will continue to investigate the variance and trainability of athletes and non-athletes.

TABLE 1

Between Subjects	df	MS	F
Factor 1: athletes vs. non-athletes	1	35	.956
Factor 2: men vs. women	1	26	.710
Factor 1 and 2 interaction effect	1	17	.464
Between subject error term	20	36.5	
Within Groups			
Factor 3: visual skills	11	4045	233.815*
Factor 1 and 3: interaction effect	11	47.5	2.746**
Factor 2 and 3: interaction effect	11	27.3	1.578
Factors 1,2 and 3: interaction effect	11	14.5	0.838
Within group error term	220	17.3	

*p < .001

**p < .005

TABLE 2

"Data Snooping" t-test

Groffman Visual Tracing (athletes vs. non-athletes)	<u>t-score</u>
OAX	0.367
CSX	3.43
CS	-.49
McDonald's Peripheral Awareness (Athletes vs. non-athletes)	
Quadrant 1	0.49
Quadrant 2	0.30
Quadrant 3	0.42
Quadrant 4	0.36
Duane Saccadic Fixator (athletes vs. non-athletes)	
Proaction	-0.49
Reaction	-3.37*
Predictability	0.49
Dynamic Visual Acuity	
Athletes vs. non-athletes	1.97**
Men vs. women	1.16

*p < .001

**p < .025

REFERENCES

- 1 Beals, R.P., A.M. Mayyasi, A.E. Templeton, and W.L. Johnson. "The Relationship Between Basketball Shooting Performance and Certain Visual Attributes." American Journal of Optometry and Archives of the American Academy of Optometry. 48(7): 585-590, 1971.
- 2 Burg, A. "An Investigation of Some Relationships Between Dynamic Visual Acuity, Static Visual Acuity and Driving Record." Report 64-18, Los Angeles, California: University of California Engineering Dept., 1964.
- 3 Burg, A. "Visual Acuity as Measured by Dynamic and Static Tests: A Comparative Evaluation." J. Appl. Psychol. 50: 460-466, 1966.
- 4 Burg, A. and S. Hulbert. "Dynamic Visual Acuities as Related to Age, Sex, and Static Acuity." J. Appl. Psychol. 45: 111-116, 1961.
- 5 Hulbert, S.F., A. Burg, and J.H. Mathewson. "A Preliminary Study of Dynamic Visual Acuity and its Effect on Motorists' Vision." J. Am. Optom. Assoc. 29: 359-364, 1958.
- 6 Miller, J.W., and E.J. Ludvigh. "The Results of Testing the Dynamic Visual Acuity of 1000 Naval Aviation Cadets." NSA, -571, Pensacola, FL: Naval School of Aviation Medicine, 1956.
- 7 Morris, G.S.D. and E. Kreighbaum. "Dynamic Visual Acuity of Varsity Women Volleyball and Basketball Players." Research Quarterly. 48(2): 480-483, 1977.
- 8 Sanderson, F.H. and H.T.A. Whiting. "Dynamic Visual Acuity and Performance in a Catching Task." Journal of Motor Behavior. 6(2): 87-94, 1974.
- 9 Weissman, S. and C.M. Freeburne. "Relationship Between Static and Dynamic Visual Acuity." J. Exp. Psych. 70: 141-146, 1965.

RAW DATA

Pegs	Grodfman			Pencil				Successes			DVA velocity	Total	Total w/ DVA
	max	CSF	OS	1	2	3	4	1	2	3			
1) 8	23.2	24.0	2	6	6	6	6	26	15	4	39	165.2	2.2
2) 5	30.6	23.0	4	6	7	7	6	17	4	2	45	156.6	1.1
3) 4	29.0	28.3	3	4	5	4	4	19	11	1	60	172.3	1.1
4) 8	30.0	36.0	1	7	6	6	6	25	12	3	45	185.0	1.4
5) 10	31.0	31.0	5	4	5	5	7	27	13	2	63.75	203.75	14.0
6) 6	35.0	35.5	4	6	5	5	6	25	5	2	42	176.5	14.1
7) 41	178.8	177.8	19	33	34	33	35	139	60	14	244.25	1059.35	1
8) 6	25.2	80.5	2	5	5	6	4	19	1	2	52.5	158.2	1.1
9) 11	30.4	30.5	4	6	7	6	7	24	15	2	42	184.9	1.1
10) 12	31.4	32.0	1	6	5	5	7	20	20	4	42	186.4	1.1
11) 12	29.6	32.6	3	7	5	7	6	28	11	3	31.5	175.7	1.4
12) 12	28.4	29.6	3	7	5	4	6	16	3	4	45	159.0	1.1
13) 15	20.4	35.0	1	7	7	6	7	24	19	4	40.5	185.9	4
14) 44	165.4	190.2	14	38	35	34	37	131	69	19	253.5	1050.1	7.1
15) 105	348.2	368	33	71	69	67	72	270	129	33	548.25	2109.45	1
16) 14	26.8	27.75	4	4	7	6	6	26	16	3	48	188.55	1.1
17) 3	33.8	34.25	4	6	6	6	5	25	18	4	37.5	182.55	1.1
18) 10	29.8	29.5	4	5	4	3	5	26	20	3	37.5	176.8	1.1
19) 8	28.2	21.3	3	7	6	5	6	26	17	6	36	163.5	1.1
20) 7	33.2	33.2	5	5	3	4	6	26	25	3	39	189.4	1.1
21) 13	29.2	0	0	4	6	7	6	21	16	0	40.5	142.6	1.1
22) 55	181.4	146	20	31	32	31	34	150	112	13	238.5	1043.9	5.4
23) 7	29.4	35.0	1	6	5	5	5	27	25	3	44.5	194.9	1.1
24) 14	28.5	28.5	5	6	4	6	6	22	7	3	37.5	167.5	1.1
25) 15	27.4	27.4	5	5	7	5	7	26	8	3	54	189.8	1.1
26) 7	28.6	28.6	5	6	5	3	4	17	18	0	26.25	148.45	1.1
27) 7	30.2	29.0	1	5	6	5	5	20	10	0	37.5	155.7	1.1
28) 7	12.5	17.75	4	4	5	5	5	16	4	3	25.5	108.75	1.1
29) 57	156.6	166.25	21	32	32	29	32	128	72	12	227.25	965.1	1.1
30) 112	338	32.25	41	63	64	60	66	278	184	25	465.75	2009	3104.45
											+ 548.25	4118.45	3104.45